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EXAMINER

SMITH, NICHOLAS A

ART UNIT PAPER NUMBER

1742

DATE MAILED: 10/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/627,165

Applicant(s)

LAURSEN ET AL.

Examiner

Nicholas A. Smith

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's arguments, see p.7, filed 7/13/2006, with respect to the rejection(s) of claim(s) 1, 13 and 17 under Chen et al. have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Ueno (US Patent 6,245,676).

Claims Status

2. Claims 1-21 remain for examination.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 1, 7-8, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno in view of Saka et al. (US Patent 6,476,921).

5. In regards to claims 1 and 17, Ueno discloses a method of planarizing a semiconductor surface comprising a field region and a plurality of features (Fig. 1, col. 1, lines 43-58), forming a barrier layer overlying at least the field region (col. 1, lines 43-48), electrodepositing a layer comprising copper having a substantially planar upper surface overlying the barrier layer and filling the features in the insulating layer (col. 1, lines 55-59 and Fig. 1c), and polishing the layer comprising copper and the barrier layer to remove the layer comprising copper and the barrier layer from the field region using a

standard chemical mechanical polishing technique (CMP) (col. 14, lines 63-67 and Fig. 2b).

6. However, Ueno does not go into great detail about the CMP process and thus does not specifically teach removal of copper and barrier layer on a single platen.

7. Saka et al. teaches a CMP process that teaches removal of copper and barrier layer on a single platen (col. 4, lines 29-56). It would have been obvious to one of ordinary skill to modify Ueno's CMP method with Saka et al.'s CMP method for the purpose of reducing equipment necessary (for example, other platens in the CMP process) to perform CMP.

8. In regards to claim 7, Ueno does not specifically disclose the insulating film as a low k dielectric. However, as evidenced by Saka et al, it is routinely known that insulating films on semiconductor wafer are commonly low dielectric constant materials (Saka et al., col. 4, lines 41-44).

9. In regards to claim 8, Ueno does not specifically disclose polishing the insulating layer.

10. Saka et al. teaches polishing of insulating layer (col. 4, lines 34-37). It would have been obvious to one of ordinary skill in the art to modify Ueno's process with Saka et al.'s polishing of insulating layer in order to remove surface material (Saka et al., col. 4, lines 34-37).

11. Claims 2-3, 9-11, 13-14, 16 and 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno in view of Saka et al. in regards to claim 1, and further in view of Hsu et al. (US 2003/0040188).

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12. In regards to claim 2, Ueno in view of Saka et al. does disclose chemical mechanical planarizing as stated above in paragraphs 5-7, but does not specifically disclose using a soft polishing pad.

13. Hsu et al. teaches the use of a soft polishing pad as conventional in electrochemical mechanical polishing or chemical mechanical polishing process (paragraph [0064] and [0077]). It would have been obvious to one of ordinary skill in the art at the time of invention to use the soft polishing pad of Hsu et al. in Ueno in view of Saka et al.'s process as such practice is conventional in the arts of electrochemical mechanical polishing and chemical mechanical polishing (Hsu et al, paragraphs [0064] and [0077]).

14. In regards to claim 3, while Hsu et al. does not specifically disclose the claimed range on the hardness scale for a soft polishing pad, since Hsu et al. discloses the same supplier and trade name as defined in the instant specification (paragraph [0023]), the same products (pads) would have the substantially the same properties.

15. In regards to claim 9-10 and 18, Ueno in view of Saka et al. do not specifically disclose a multi-platen apparatus and performing electrodepositing and polishing steps on separate platen or cleaning on a third platen.

16. Hsu et al. teaches a multi-platen apparatus and performing electrodepositing, polishing and cleaning steps on separate platen (Fig. 7 and paragraphs [0113] and [0135]). It would have been obvious to one of ordinary skill in the art to modify Ueno in view of Saka et al.'s process with Hsu et al.'s multi-platen process in order to provide modularity and ease of replacing components in a system (Hsu et al, paragraph [0049]).

17. In regards to claim 11, Ueno in view of Saka et al. do not specifically disclose the claimed thickness range of copper deposited.

18. Hsu et al. discloses a range of copper thickness deposited (paragraph [0122]) that overlaps the claimed thickness range of copper deposited and thus establishes a prima facie case of obviousness. See MPEP 2144.05.

19. In regards to claim 13, Ueno in view of Saka et al. and further in view of Hsu et al. is applied the claim for same reasons as stated in paragraphs 5-8 above.

20. Furthermore, Hsu et al. teaches wherein the depositing process is electrochemical mechanical plating and forming a seed layer (paragraph [0106] and claim 7). It would have been obvious to one of ordinary skill in the art to modify Ueno in view of Saka et al.'s process with Hsu et al.'s electrochemical mechanical plating in order to deposit material and concurrently planarize the substrate (Hsu et al., paragraph [0106]).

21. In regards to claim 14, Hsu et al. teaches electrochemical mechanical polishing (ECMP) (paragraph [0106]). It would have been obvious to one of ordinary skill in the art to modify Ueno in view of Saka et al.'s process with Hsu et al.'s ECMP in order to planarize the substrate (Hsu et al., paragraph [0106]).

22. In regards to claim 16, Ueno in view of Saka et al. and further in view of Hsu et al. are applied to the claim for the same reasons as stated in paragraphs 5-8 and 12-13 above.

23. In regards to claim 19, Hsu et al. discloses robotically moving a workpiece to a second platen of the multi-platen apparatus (paragraph [0054]).

24. In regards to claim 20, Hsu et al. teaches alignment of workpiece with respective first and second platens with a robot (paragraph [0054]).

25. In regards to claim 21, Ueno in view of Saka et al. and further in view of Hsu et al. are applied to the claim for the same reasons as stated in paragraphs 5-7 and 12-14 above. Furthermore, Hsu et al. teaches a pressure applied range that substantially overlaps the claimed pressure range and therefore a prima facie case of obviousness is established. See MPEP 2144.05.

26. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno in view of Saka et al. and further in view of Hsu et al. in regards to claim 2, and further in view of Sinha et al. (US Patent 6,551,935).

27. In regards to claim 4, Ueno in view of Saka et al. and further in view of Hsu et al. do not disclose a process wherein there is a presence of a polishing slurry has a copper:barrier layer selectivity of substantially 1:1.

28. Sinha et al. discloses a CMP process wherein there is a presence of a polishing slurry has a copper:barrier layer selectivity of substantially 1:1 (abstract). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Ueno in view of Saka et al. and further in view of Hsu et al.'s process with Sinha et al.'s polishing slurry with claimed selectivity in order to keep gaps from forming locations where the barrier material should be located and consequently keep the copper layer from undesirably diffusing into unprotected regions of the substrate (Sinha et al., col. 2, lines 25-52).

29. Claims 4-6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno in view of Saka et al., and further in view of Hsu et al. in regards to claim 2, and further in view of Mahulikar et al. (US Patent 6,776,696).

30. In regards to claim 4, Ueno in view of Saka et al. and further in view of Hsu et al. do not disclose a process wherein there is a presence of a polishing slurry has a copper:barrier layer selectivity of substantially 1:1.

31. Mahulikar et al. teaches a process wherein there is a presence of a polishing slurry has a copper:barrier layer selectivity of substantially 1:1 (col. 2, lines 49-51). It would have been obvious to one of ordinary skill in the art to apply Mahulikar et al.'s slurry to Ueno in view of Saka et al. and further in view of Hsu et al.'s process in order to get the best topography (Mahulikar et al., col. 2, lines 49-51).

32. In regards to claim 5, Ueno in view of Saka et al. and further in view of Hsu et al. do not disclose a process wherein there is a presence of a polishing slurry has a copper:barrier layer selectivity of substantially greater than 1:1.

33. Mahulikar et al. teaches the use of two separate slurries on a single platen with the claimed slurry selectivities (col. 2, lines 49-51, col. 3, line 40 to col. 4, line 5, col. 5, lines 38-45). It would have been obvious to one of ordinary skill in the art to apply Mahulikar et al.'s two slurries to Ueno in view of Saka et al. and further in view of Hsu et al.'s process in order to save processing time (Mahulikar et al., col. 5, lines 14-18).

34. In regards to claim 6, Ueno in view of Saka et al. and further in view of Hsu et al. do not disclose a process wherein the steps of cleaning and buffing the field region on the single platen are done following the step of polishing.

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35. Mahulikar et al. teaches a process wherein the steps of cleaning and buffing the field region on the single platen are done following the step of polishing (col. 2, line 60 to col. 3, line 9). It would have been obvious to one of ordinary skill in the art to apply Mahulikar et al.'s single platen for cleaning and buffing to Ueno in view of Saka et al. and further in view of Hsu et al.'s process in order to save processing time (Mahulikar et al., col. 5, line 3-7).

36. In regards to claim 15, Ueno in view of Saka et al., further in view of Hsu et al. and further in view of Mahulikar et al. are applied to the claim as stated in paragraphs 5-8, 20 and 30-33 above.

37. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ueno in view of Saka et al. in regards to claim 1, and further in view of Mahulikar et al. (US Patent 6,776,696).

38. Ueno in view of Saka et al. and further in view of Mahulikar is applied to claim 12 for the same reason as stated in paragraphs 5-8 and 30-31 as above.

Conclusion

39. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas A. Smith whose telephone number is (571)-272-8760. The examiner can normally be reached on 8:30 AM to 5:00 PM, Monday through Friday.

40. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571)-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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41. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NAS

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